DOCUMENT RESUME

ED 062 418 TM 001 586

TITLE	Lineman, Repair (light, heat, & power) 821.381--Development of USTES Aptitude Test Battery.
INSTITUTION	Manpower Administration (DOL), Washington, D.C. U.S. Training and Employment Service.
REPORT NO	TR-S-154-R
PUB DATE	Jun 70
NOTE	14p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Aptitude Tests; *Cutting Scores; *Electrical Occupations; Evaluation Criteria; Job Applicants; *Job Skills; Norms; Occupational Guidance; *Personnel Evaluation; Test Reliability; Test Validity; Utilities
IDENTIFIERS	GATB; *General Aptitude Test Battery; Lineman

ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

ED 062418

June 1970

U.S. Training and
Employment Service
Technical Report
S-154 R

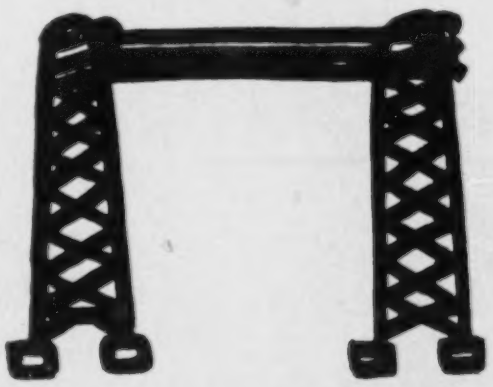
Development of USTES

APTITUDE TEST
BATTERY FOR

LINEMAN, REPAIR

(light, heat, & power)
821.381

U S DEPARTMENT OF LABOR
Manpower Administration



TM 001 586

Technical Report on Development of USTES Aptitude Test Battery

For . . . . . .

Lineman, Repair (light, heat & power) 821.381

S-154R

(Developed in Cooperation with the
Pennsylvania State Employment Service)

Manpower Administration
U.S. Department of Labor

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2228

DEVELOPMENT OF USTES APTITUDE TEST BATTERY

for

Lineman, Repair (light, heat & power) 821.381-042

S-154R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Lineman, Repair (light, heat & power) 821.381-042. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
S - Spatial Aptitude	90
K - Motor Coordination	70

RESEARCH SUMMARY

Sample:

59 men employed as Lineman at twelve companies in Pennsylvania. This study was conducted prior to the requirement of providing minority group information. Therefore, minority group composition is unknown.

Criterion:

Supervisory Ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time). Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi coefficient = .31 ($P/2 < .01$)

Effectiveness of Norms:

Only 69% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 82% would have been good workers. 31% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 18% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	69%	82%
Poor Workers	31%	18%

SAMPLE DESCRIPTION

Size: N = 59

Occupational Status: Employed workers.

Work Setting: Workers were employed as Lineman at the following twelve companies in Pennsylvania:

Company	Location
Utilities Line Construction Co.	Jenkintown
Dairs and Reed	Larchmont
Howard P. Foley Co.	Philadelphia
Day and Zim	Skippack
Vare Brothers	Ardmore
Cates and Sheppard	Llanarch
Sordoni Construction Co.	York
Henkels and McCoy	Philadelphia
W. V. Pangborne	Philadelphia
United Engineers	Eddystone
Broadway Maintenance	Philadelphia
E. H. Staples Co.	Stroudsburg

Employer Selection Requirements:

Education: None required. High school graduates were preferred.

Previous Experience: A four-year apprenticeship which consisted of on-the-job training given by the foreman and journeyman lineman and a correspondence course of 816 lessons on electrical theory.

Tests: None used

Other: Personal Interview

Principal Activities: The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience: All workers in the study had completed their apprenticeship and had at least 58 months of experience as journeyman Linemen, including at least one month for the employer who rated them.

TABLE 2

Means, Standard Deviation (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

	Mean	SD	Range	r
Age (years)	36.8	8.3	23-60	.033
Education (years)	10.7	1.9	5-15	.155
Experience (months)*	31.3	65.0	1-480	-.009

*Experience with present employer

EXPERIMENTAL TEST BATTERY

All of the tests of the GATB, B-1002A, were administered to the sample group during the period June 17, 1958 to July 23, 1958.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as the tests were administered. The immediate supervisor rated each worker.

Rating Scale:

Form SP-21 "Descriptive Rating Scale" was used. The scale (see Appendix) consists of nine items covering different aspects of job performance. Each item has five alternative responses corresponding to different degrees of job proficiency.

Reliability:

Since only one criterion rating was obtained, no reliability coefficient is reported.

Criterion Score Distribution:

Possible Range:	9-45
Actual Range:	25-45
Mean:	35.5
Standard Deviation:	5.3

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 31% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 33.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes G, N, and S which do not have high correlations with the criterion were considered for inclusion in the norms because the qualitative analysis indicated they were important for the job duties and the sample had a relatively high mean on Aptitudes G and N and a relatively low standard deviation on Aptitude S. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
G - General Learning Ability	Required to understand safety rules and principles of the occupation, understand and follow instructions, and to make judgments in meeting new situations and emergencies as they arise.
N - Numerical Aptitude	Required to make calculations of distances to poles, distances to bore holes on poles, and to figure lengths of wires. Also required to determine the sag of wires, and to build templates and place spacers underground.
S - Spatial Aptitude	Required to erect steel poles and columns, raise gin poles, and string wire.
P - Form Perception	Required to erect steel columns, read schematic drawings, build templates, and determine size of hole for poles, anchors, and tower bases.
K - Motor Coordination	Required to manipulate hand tools and to accurately place parts.
F - Finger Dexterity	Required to string and tie wires and cables and to use tools.
M - Manual Dexterity	Required to handle, place, and assemble various parts, and to use tools. Also required to climb and hook up.

TABLE 4

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

N = 59

Aptitudes	Mean	SD	Range	r
G - General Learning Ability	102.3	13.7	75-140	.186
V - Verbal Aptitude	99.8	14.2	64-137	.202
N - Numerical Aptitude	99.3	14.4	63-139	.237
S - Spatial Aptitude	98.6	14.4	65-124	.013
P - Form Perception	93.1	16.5	50-122	-.131
Q - Clerical Perception	95.6	13.0	62-143	.097
K - Motor Coordination	91.9	18.2	43-134	.289*
F - Finger Dexterity	87.5	19.0	35-122	-.024
M - Manual Dexterity	98.8	19.7	53-154	.149

*Significant at the .05 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data: Important	X		X	X	X		X	X	X
Irrelevant									
Relatively High Mean	X	X	X						
Relatively Low Standard Deviation	X	X		X		X			
Significant Correlation with Criterion							X		
Aptitudes to be Considered for Trial Norms	G		N	S			K		

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of Aptitudes G, N, S, and K at trial cutting scores were able to differentiate between the 69% of the sample considered good workers and 31% of the sample considered poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample; for four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The phi coefficient was used as a basis for comparing trial norms. The optimum differentiation for the occupation of Lineman, Repair was provided by the norms of S-90 and K-70. The validity of these norms is shown in Table 6 and is indicated by a phi coefficient of .31 (statistically significant at the .01 level).

TABLE 6

Concurrent Validity of Test Norms
S-90 and K-70

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	31	41
Poor Workers	11	7	18
Total	21	38	59

Phi coefficient (ϕ) = .31 Chi square (X^2_y) = 5.8
Significance Level = $P/2 < .01$

DETERMINATION OF OCCUPATIONAL APTITUDE NORMS

The data for this study met the requirements for incorporating the occupation studied into OAP-41 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A phi coefficient of .20 is obtained with the OAP-41 norms of S-95, Q-85, K-75.

SP-21

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Very poor. Does work of unsatisfactory grade. Performance is inferior and almost never meets minimum quality standards.

☐ 2. Not too bad, but the grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Fair. The grade of his work is mediocre. Performance is acceptable but usually not superior in quality.

☐ 4. Good, but the grade of his work is not outstanding. Performance is usually superior in quality.

☐ 5. Very good. Does work of outstanding grade. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Very inaccurate. Makes very many mistakes. Work needs constant checking.

☐ 2. Inaccurate. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Fairly accurate. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Accurate. Makes few mistakes. Work seldom needs checking.

☐ 5. Highly accurate. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Very unresourceful. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Unresourceful. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Fairly resourceful. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Resourceful. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Very resourceful. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How often does he make practical suggestions for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Never. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Very seldom. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Once in a while. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Frequently. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Very often. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how satisfactory is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Definitely unsatisfactory. Would be better off without him. Performance usually not acceptable.

☐ 2. Not completely satisfactory. Of limited value to the organization. Performance somewhat inferior.

☐ 3. Satisfactory. A fairly proficient worker. Performance generally acceptable.

☐ 4. Good. A valuable worker. Performance usually superior.

☐ 5. Outstanding. An unusually competent worker. Performance almost always top notch.

FACT SHEET

Job Title: Lineman, Repair (light, heat, & power) 821.381-042

Job Summary: Performs all operations of work entailed in the transmission, distribution, substation, and underground phases of installation, repair, replacements, and maintenance of the supply of electrical power from the power plant to the consumer.

Work Performed: Erects steel towers, poles, and extensions, attaches cross-arms, insulators, and other equipment, and strings wire to transmit high voltage electric current from generating system to substation and/or between substations.

Erects poles, secures cross-arms and equipment to poles, and strings conductors to carry electrical energy to points of use.

Erects steel columns, towers, trusses, and buses; assembles gear; installs switches; hooks up transformers, oils circuit breakers and controls.

Lays out and installs duct, inserts cable to transmit electrical energy underground, and connects conductors to terminals.

Effectiveness of Norms:

Only 69% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the S-154R norms, 82% would have been good workers. 31% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the S-154R norms, only 18% would have been poor workers.

Applicability of S-154R Norms:

The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898.706